

**STATEMENT OF
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BEFORE THE

**SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES**

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*The Role of Research in Addressing Climate Change
in Transportation Infrastructure*

Chairman Wu, Ranking Member Smith, and Members of the Committee.

Thank you for the opportunity to appear before you today to discuss climate change research at the U.S. Department of Transportation (DOT), including past and current activities and future research needs.

The Obama Administration considers climate change a major priority. The President is committed to aggressive action to reduce the impacts of climate change and ensure that the U.S. is a leader in the global effort to reduce greenhouse gas emissions.

President Obama has called for a number of fundamental policy changes to revolutionize the way we use energy, including:

- Enacting cap-and-trade legislation designed to achieve a rapid and profound transformation;
- Increasing the production and use of renewable energy.
- Strengthening efforts to build a clean energy future while creating millions of new jobs through strategic investment of billions of dollars over the coming years;
- Getting on the road plug-in hybrid cars that get radically better fuel economy;

The President has already initiated other ambitious and far-reaching actions to lower greenhouse gas emissions. The President:

- Announced policies that will improve the fuel efficiency of automobiles, significantly reducing dependence on foreign oil and cutting U.S. emissions of greenhouse gases;
- Signed the American Recovery and Reinvestment Act of 2009, which intensifies U.S. actions on energy efficiency and renewable energy; and

- Directed a review to determine how to best regulate U.S. greenhouse gas emissions.

The President's actions signal a renewed U.S. commitment to lead global efforts confronting climate change. DOT will continue working with our Administration colleagues and this committee to meet these goals, building on current research, and defining the next climate related research and development agenda to ensure we tackle the right issues and reduce the transportation sector's greenhouse gas emissions.

Transportation accounts for about 30 percent of total greenhouse gas emissions.¹

Transportation-related greenhouse gases include carbon dioxide (CO₂) nitrous oxide (N₂O) methane (CH₄), and hydrofluorocarbons (HFC). Carbon dioxide is the most commonly emitted greenhouse gas, accounting for 95 percent of U.S. transportation emissions in 2006. Transport sector emission sources include:

- light-duty trucks and passenger cars (59.3 percent);
- medium- and heavy-duty trucks (19.6 percent);
- aircraft (12.5 percent);
- rail (2.7 percent);
- marine (4.9 percent); and
- pipelines (1.5 percent).

Transportation life cycle emissions, which consider the entire extraction, production, and use of materials, give a larger picture of transportation's greenhouse gas emissions. For instance, while burning fuel to operate vehicles amounts to 60% of light duty vehicle life cycle emissions, 17% of emissions come from construction and maintenance of infrastructure such as roadways and parking, 10% of emissions come from the fuel production cycle, and 12% come from vehicle manufacture. Transportation infrastructure life cycle emissions include emissions from the production of roadway materials, such as asphalt and concrete; fleet vehicles necessary for constructing and maintaining roadways and other transportation infrastructure; and traffic impacts of work zones.

CURRENT DOT RESEARCH

While there is much more to do, the Department has taken steps to address transportation related greenhouse gas emissions through its research activities.

As transportation both contributes to and is affected by climate change, the Department's research has focused both on mitigation of transportation's contributions to greenhouse gas emissions and adaptation to potential impacts on infrastructure. This research addresses improving vehicle fuel economy, developing alternative fuels, and improving system efficiency.

DOT's climate change research activities have been developed through interagency groups and within the Department. DOT has actively participated in the Interagency Working Group on Climate Change Science and Technology and its subordinate groups, the Climate Change

¹ EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006

Science Program (CCSP) and the Climate Change Technology Program (CCTP). DOT has followed the research guidance provided by the Office of Science and Technology Policy. Research agendas are set within the Department through DOT's Center for Climate Change and Environmental Forecasting Strategic Plan as well as the individual research agendas of specific modal administrations. All of these efforts have been informed by stakeholder input. The Department has also cooperated with the Transportation Research Board (TRB).

CENTER FOR CLIMATE CHANGE AND ENVIRONMENTAL FORECASTING

DOT's virtual Center for Climate Change and Environmental Forecasting sets priorities for most multimodal climate change policy analysis and research. The Center's Strategic Plan for 2006-2010, released in 2006, contained four strategy areas: Research and Policy Analysis; Integrated Approaches and Mutual Benefits; State and Local Transportation Planning; and Communication, Education, and Capacity Building.

The virtual Center's work is carried out by operating administration staff. Most of DOT's operating administrations make voluntary financial commitments to fund Center activities and research.

One example of the Center's work is DOT's *The Impacts of Climate Variability and Change on Transportation Systems and Infrastructure*. The report was conducted under the Climate Change Research Initiative to provide information for decision makers. This case study of the Gulf Coast was designed to understand the possible effects of climate change on transportation infrastructure and aid transportation decision makers in determining how to account for potential impacts in the transportation planning process. Phase I of the study was completed in 2008 and studied how changes in climate over the next 50 to 100 years could affect transportation systems in the U.S. central Gulf Coast region. Phase II, currently under development, will explore more detailed information about impacts at the local level. It will develop tools and guides for transportation planners including a *risk assessment tool* to allow decision makers to understand vulnerability to climate change. This important work has already gained considerable interest within the transportation community about planning for transportation investments.

The Center is currently overseeing preparation of a Report to Congress on the impact of the nation's transportation system on climate change, and solutions to mitigate climate change by reducing greenhouse gas emissions from the transportation sector.

The report, mandated by the Energy Independence and Security Act of 2007, will identify national policy approaches, evaluate pros and cons, and estimate magnitudes of emission reductions. This research will allow DOT to evaluate the implications of various approaches on other transportation goals. The report, expected to be completed mid summer, will consider co-benefits of fuel savings and air quality improvement. The report results will compare strategic options to reduce transportation emissions and will inform future research and policy development.

The Center's Transportation and Climate Clearinghouse was launched in early 2009 and includes information on greenhouse gas inventories, analytic methods and tools, greenhouse

gas reduction strategies, potential impacts of climate change on transport infrastructure, and approaches for integrating climate change considerations into transportation decision making.

FAA

Additional mitigation efforts are underway throughout DOT. The FAA leads the transformation to the Next Generation Air Transportation System (NextGen). One NextGen key environmental goal is to limit or reduce the impact of aviation greenhouse gas (GHG) emissions on the global climate. To achieve this, one key approach is to more efficiently use the Nation's airspace, which will in itself lead to less fuel use and therefore have a positive GHG and air quality impact. In an effort to reduce fuel burn and other emissions, the FAA is developing and improving environmentally friendly procedures covering gate to gate, terminal, and surface operations.

Fully achieving this goal, however, will also require better understanding of atmospheric science, as multiple interrelated impacts due to aviation emissions influence climate change as well as ambient air quality. Associated magnitudes and metrics needed to express climate impacts properly are not well known. While pressure exists to identify and implement solutions, effective solutions must be based on a full understanding of the underlying science.

The FAA is leading work to improve scientific understanding of the impacts of aviation emissions on climate. With participation from the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA), the FAA recently launched the Aviation Climate Change Research Initiative (ACCRI) to accelerate scientific understanding that will inform policy decisions on mitigation. Funding for ACCRI was included in the recent Fiscal Year 2009 Omnibus bill, and FAA expects to initiate efforts in the next few months.

Aside from ACCRI, FAA is pursuing a number of research and development initiatives to reduce aviation emissions at the source. With support from NASA, the FAA recently launched the (Continuous Lower Energy Emissions and Noise) CLEEN Program to advance maturing engine and aircraft technologies for quick deployment into the fleet in order to increase in fuel efficiency and reduce emissions.

The FAA helped form -- and is an active participant in -- the Commercial Aviation Alternative Fuels Initiative (CAAIFI), which was one of the subjects discussed at the hearing on Aviation Biofuels held by the Subcommittee on Space and Aeronautics last week. CAAIFI seeks to develop and deploy alternative jet fuels for commercial aviation which offer reductions in life cycle emissions. The CLEEN Program also supports this effort.

In addition, FAA is conducting research to inform Administration decisions about potential impacts on domestic and international aviation of possible policies such as aircraft carbon emissions standards, emissions cap and trade, and carbon taxes on aviation emissions and their impacts on the climate change.

FHWA

Research specific to the FHWA includes mitigation and adaptation work on improvements to system efficiency, land use, planning. The FHWA is working to evaluate how land use, transportation infrastructure, and policy changes would affect travel activity and greenhouse gas emissions. Analysis tools developed by this research will be used by planners and policy makers. FHWA is also determining how new energy and greenhouse gas performance goals impact fundamental transportation system performance and inform the development of measures for reducing emissions. Additional work is going on at the State DOT and Metropolitan Planning Organization (MPO) levels.

FHWA is also developing a strategy to address adaptation issues, including a framework to conduct assessments and determine data gaps of transportation infrastructure most vulnerable to the effects of climate change. Guidelines will be developed concerning consideration of climate change impacts and adaptation in project development and environmental review.

The DOT report on *Potential Impacts of Global Sea Level Rise on Transportation Infrastructure* used multiple data sources to identify the potential impact of sea level rise on land and transportation infrastructure along the Atlantic Coast, from Florida to New York. The study created maps of land and transportation infrastructure that, without protection, could be inundated regularly by the ocean, or stand at risk of periodic inundation due to storm surge under a range of sea level rise scenarios. The study produced statistics to demonstrate the potential extent of land areas and transportation infrastructure affected.

Additionally, FHWA has research underway to demonstrate the value of sequestering or capturing carbon from the highway right-of-way (ROW) through modified maintenance and management practices and through changes to the type of vegetation planted. The effort was initiated to help State DOTs reduce emissions and maintenance costs and other environmental benefits such as reduced erosion, better retention of stormwater in soil, enhanced ability to hold snow, and improved wildlife habitat.

FHWA conducts several activities that reduce greenhouse gas emissions from transportation infrastructure construction. The Department is working closely with the hot mix asphalt industry on warm mix asphalt which allows production of asphalt mix at lower temperatures, thereby reducing fuel use and emissions. FHWA is also expanding efforts to increase the use of recycled asphalt and concrete pavements, roofing shingles and other potential reuse materials in the construction of highways, which reduces the cost of emissions related to extraction of mineral resources, the production of highway materials and the transportation of materials. The concrete industry has worked hard to reduce emissions resulting from the production of cement through modifications to the production process and greater use of alternative materials such as fly ash and lime. FHWA is conducting research to expand the amount of fly ash that can be used in concrete paving.

FHWA through its Turner Fairbank Highway Research Center (TFHRC) is developing or conducting R&D on mitigation and adaptation of infrastructure for climate change. FHWA also actively participates in the National Science and Technology Council Subcommittee on

Disaster Reduction (SDR). SDR focuses on science and technology issues to reduce disaster vulnerability covering all natural and technology hazards which include climate change issues. Currently research at TFHRC is being conducted on bridge vulnerability to hydraulic events such as flooding, scour and storm surges. Today most bridge failures occur in the US due to flooding and scour; this could significantly increase due to climate changes such as changing water levels and storm intensities. Other ongoing and planned research with potential to reduce the impact the effects of climate change include: development of guide specifications for bridges vulnerable to coastal storms and a handbook of retrofit options; optimum bridge deck shapes to minimize pressure flow scour; and development of hydrodynamic bridge systems to address flooding, overtopping, scour, surge and wave actions.

FHWA also has several programs underway to develop and implement innovative solutions to reduce traffic congestion and its effects on the environment, including: enhanced design and implementation of work zones; quicker response to traffic incidents; improved timing of traffic signals and other traffic management strategies; provision of information to allow travelers to make informed decisions on route, mode and timing of trips; and better balancing supply and demand through congestion pricing where appropriate.

FTA

The FTA's research on climate change falls into two main areas:

- 1) policy-oriented research investigating the potential for expanded public transportation service and transit-oriented development to reduce overall transportation emissions while providing convenient and economic mobility options; and
- 2) technology research that will enable local public transportation agencies to provide their already relatively energy efficient service in an even more efficient manner.

FTA conducts ongoing research on the synergies from combining investment in public transportation with compact, mixed-use development around transit stations. These synergies amplify the greenhouse gas reductions of each strategy. FTA is funding a new synthesis on greenhouse gas emission savings from transit through the Transit Cooperative Research Program. FTA also has sustainability partnership projects with key stakeholders, the American Public Transportation Association and the Association of Metropolitan Planning Organizations.

FTA research on alternative fuels and high fuel efficiency vehicles has contributed to the introduction of low emission technologies such as hybrid-electric buses, compressed natural gas vehicles, and biodiesel. FTA is planning research on improving the energy efficiency of electric rail propulsion and hybrid bus technology. FTA's National Fuel Cell Bus Program is developing and demonstrating fuel cell transit bus technology.

MARAD

The Maritime Administration has partnered with academia to develop a model known as the Geospatial Intermodal Freight Transport (GIFT) tool. The model is unique in that it identifies optimal freight transportation routing pathways based on minimization of energy and emissions (including CO₂), as well as time and cost. The current project is being developed regionally but will ultimately be incorporated into a national-scale model. The Maritime Administration is also working with ports and vessel operators exploring methods for using cold iron technology to provide shore-based power in order to reduce greenhouse gas and other air polluting emissions from vessels.

NHTSA

The National Highway Traffic Safety Administration (NHTSA) promulgates fuel economy regulations for passenger and non-passenger automobiles. On March 27, 2009, Secretary of Transportation Ray LaHood announced that DOT has posted the new fuel economy standards for cars and light trucks for the 2011 model year, and also noted that work on a multi-year fuel economy plan for model years after 2011 is already well underway. NHTSA's 2011 fuel economy will set the US on a course to meet the requirement of the Energy Independence and Security Act (EISA) for a fleet wide fuel economy performance of at least 35 miles-per-gallon (MPG) by 2020. NHTSA is hard at work on the next round of rulemaking, which will include a thorough Environmental Impact Statement reviewing the impact of fuel economy standards on climate change and other environmental issues.

For the first time NHTSA was given authority under EISA to address options to regulate the fuel economy of medium and heavy duty trucks, the second largest contributor to domestic transportation greenhouse gas emissions. NHTSA has initiated a study with the National Academies of Sciences to study the potential methods.

NHTSA is also simultaneously working on implementing the other provisions of EISA, including the establishment of a new consumer information program for fuel efficiency of replacement tires. This program will serve to educate consumers about the effect of tires on fuel efficiency, safety and durability.

RITA

The Research Innovative Technology Administration (RITA) coordinates the majority of the Department's surface transportation research on alternative fuels, alternative vehicles and hydrogen fuels and fuel cells. RITA released its Transportation Vision for 2030 in January of 2008. The Transportation Vision included environmental sustainability as a high priority, envisioning a future transportation network that will curb greenhouse gas emissions.

RITA coordinates research throughout the Department on advanced vehicle technology, including multiple research projects covering emissions testing and performance evaluation of advanced diesel engines, development of fuel cells, and advanced transit and bus technologies and research to better understand biofuel emissions. RITA also manages hydrogen research

projects. Multiple research projects are ongoing regarding hydrogen, including finding safe and effective storage materials, testing hydrogen fuel cell vehicles, and training emergency responders on characteristics of hydrogen.

While not a complete summary of all DOT activities, this provides an overview of DOT's current research.

Climate related research is crucial for the transportation sector to address the mitigation of greenhouse gases and the need to adapt to likely impacts of climate change.

As transportation is the fastest growing end-use sector, DOT plans to continue research in the short and long term on identifying the most effective strategies to mitigate greenhouse gas emission from transportation. Identification of areas where additional science is needed to determine the most effective practices is critically important. Mitigation research would include, for example, vehicle efficiency and low carbon fuels technologies, integrating land use and transportation planning, systems efficiencies, and operational practices that could reduce energy consumption from transportation systems.

DOT also plans to continue policy-oriented research that examines the effectiveness of different policies employed by the U.S., federal agencies, or other countries to reduce greenhouse gas emissions from transportation, including policies such as emissions standards, tax incentives, and land use practices. The results of this research could be used to shape current transportation policies and near term transportation decisions to reduce greenhouse gas emissions.

Longer term research that focuses on transformational technologies and strategies will also be needed to achieve significant reductions.

DOT has focused its research on reducing emissions from transportation sources. DOT has conducted fewer research studies with respect to climate change contributed by building transportation infrastructure and has instead focused on infrastructure adaptation research. Significant investments in transportation infrastructure could be vulnerable as a result of potential climate impacts.

DOT plans to continue adaptation research to build on DOT's seminal Gulf Coast study, to identify vulnerable infrastructure and plan future infrastructure taking these impacts into account. Adaptation research would focus on developing risk assessment tools and reassessing current design and operations standards to better plan transportation systems of the future. Additional climate science and weather research is also planned to develop information on the range of potential future environmental conditions affecting transportation infrastructure over the longer term. This includes providing more regional or local scale information of climate change impacts; developing further understanding of how projected climate change influences weather patterns and the ultimate effects on the natural environment. Such research is needed to inform transportation investment decisions, which should be made in light of long-term environmental (out 50 to 100 year) conditions. As many important impacts on transportation infrastructure will result from the incidence of extreme

conditions such as localized flooding from heavy downpours and other severe weather events, more information is needed to prepare the transportation community for these likely events.

The transportation sector may also need to more rigorously examine transportation construction contributions to climate change and opportunities to mitigate emissions, building on the work that DOT has already initiated. This is especially relevant as the transportation sector seeks the most efficient strategies to adapt to the potential national, mandatory cap and trade program called for by the President.

DOT will continue to balance the need to reduce transportation-related climate emissions while continuing to support efforts to attain air quality and water quality standards, learn more about harm from air toxics related to transportation, and maintain noise reductions. Climate research provides the opportunity to identify the potential co-benefits of mitigation strategies, such as reductions in criteria air pollutants, as well as potential unintended consequences of mitigation strategies, such as increased risks to public health.

DOT will continue to work with the White House Office on Energy and Climate Change Policy, the other Federal agencies, and the transportation community to identify and pursue the most critical climate research priorities. DOT's Climate Center will undertake a new strategic plan which will provide an excellent opportunity to develop a future climate-related transportation research agenda.

I look forward to working with this committee as we consider a transportation research and development agenda that enables our nation to better meet the challenge of climate change.

Thank you again, and I will be happy to respond to any questions you may have.